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# FINAL REPORT
# MINISYMPOSIUM SERIES ON INVERSE PROBLEMS AND OPTIMAL DESIGN IN INDUSTRY AT THE 1993 SIAM ANNUAL MEETING

July 12-16, 1993
Wyndham Franklin Plaza Hotel
Philadelphia, PA

This grant provided financial support for a series of minisymposia on inverse problems and optimal design which were held in conjunctionwith the 1993 SIAM Annual Meeting, July 12-16, 1993. The minisymposia complemented the sessions held at the Symposium on Inverse Problems and Optimal Design in Industry which was held July 8-10, 1993. Both meetings took place in Philadelphia, PA.

## ORGANIZATION of the MINISYMPOSIA

The series of minisymposia took place July 12 and 13 as part of the SIAM Annual Meeting. They were an extension of the Symposium on Inverse Problems and Optimal Design in Industry. There were over thirty speakers in the Symposium from a wide range of countries including Japan, Germany, The Netherlands, France, Italy, Norway, Finland, Austria, and the U.S. Most of the speakers were from industry and all speakers talked about applications to industrial problems. The series of minisymposia were well attended considering that a total of 1042 attended the SIAM Annual Meeting.

A major goal of the combined program of the minisymposium series and the Symposium was the interaction of academics, government laboratory, and industrial researchers. The purpose was to promote discussion and exchange of information about the many facets of inverse problems and optimal design, including:

- o correct modeling of the physical problems;
- o identification of data sufficient to make a good estimate of the solution;
- o identification of data sets such that the inverse or identification problems are well-posed and stable;
- o analysis and numerical implementation of stable algorithms;
- o comparison with experimental data.

The interaction of researchers from academia, government laboratories, and industry was productive. Graduate students and postdoctoral fellows also benefited from exposure to the wide range of ideas and problems confronting researchers in industry.

## THE PROGRAM

The minisymposia focused on inverse problems and optimal design. Four minisymposia are organized. Of particular interest was a minisymposia which focused on problems of interest to ONR and AFOSR. The emphasis was on descriptions of physical problems and the associated mathematical models. The topics covered were ocean acoustics, sea ice, radar, and biomedical problems. The topics covered in ocean acoustics were the propagation of signals and the identifying of signal sources in the ocean. A vast number of open sea ice problems were described. The talk on radar imaging focused on techniques and mathematical models which are used for the quick identification of objects from limited data obtained from radar. Application of inverse scattering methods to biomedical problems were presented. The remaining minisymposia were on mathematical methods for inverse problems, application of inverse spectral





methods to inverse problems, and optimal design. A list of minisymposia, organizers and speakers follows.

Inverse Problems and Optimization: Problems of Interest to DOD
Organized by Joyce McLaughlin, Rensselaer Polytechnic Institute
and David Colton, University of Delaware

Dr. Richard Albanese, Brooks Air Force Base
"Mathematics, Microwaves, and Medical Imaging"
Dr. Michael Collins (and W.A.Kuperman), Naval Research Laboratory
"Inverse Problems in Ocean Acoustics"
Dr. Art Jordan, Naval Research Laboratory
"Electromagnetic Remote Sensing of Arctic Sea Ice"
Dr.Brett Borden, Naval Air Warfare Center
"Extended Phase Front Derivative Imaging for Practical Radar Based Noncooperative Target Recognition"

Inverse Spectral Problems
Organized by Professor William Rundell, Texas A&M University, College Station

Professor Ole Hald, University of California, Berkeley
"Differential Equations and Number Theory"
Professor Graham Galdwell, University of Waterloo, Canada
"Reconstruction of Some Discrete Vibrating Models from Eigendata"
Professor Bruce Lowe, Texas A&M University, College Statioon
"Determination of Multipole Coefficients in a Second Order Differential Equation from Input Sources"
Professor Roger Knobel, Texas A&M University, College Station
"A Finite Difference Algorithm for an Inverse Sturm-Liouville Problem"

Mathematical Methods in Inverse Problems
Organized by Professor Victor Isakov, Wichita State University

Dr. Erkki Somersalo, University of Helsinki, Finland
"Inverse Problems for Systems"
Professor Victor Isakov, Wichita State University
"Prospecting Discontinuities by Boundary Measurements"
Professor Adrian Nachman, University of Rochester
"The d-bar Method in Inverse Boundary Value and Inverse Scattering Problems"
Professor John Sylvester, University of Washington
"The Layer-Stripping Method in Impedance Tomography"

Optimal Design
Organized by Steven J. Cox, Rice University

Professor Robert Lipton, Worcester Polytechnic Institute
"Optimal Design in a Random Environment"
Professor Noboru Kikuchi, University of Michigan
"Optimal Topology Design for Structural Vibrations and Eigenvalue Problems"
Dr. David Dobson, University of Minnesota, Minneapolis
"Optimal Design of Periodic Antireflective Structures for Time-Harmonic Waves"
Professor Robert B. Haber, C.S. Job and M.P. Bendsoe
University of Illinois, Urbana
"Topology Design for Manufacturability Using a Self-Adaptive Material Model"

SIAM received funding for partial reimbursement of the travel and per diem expenses for students, postdocs, and some of the minisymposia speakers and organizers. SIAM obtained dormitory rooms for students and postdocs who were funded by this grant. This enabled a number of researchers, actively doing work in inverse problems and optimal design, and a number of students to attend. Several of the students who attended were very positive about the activities on inverse problems which took place at the meeting.

It is important to point out that at the request of Professor Mario Bertero, an editor for INVERSE PROBLEMS, a Proceedings for the Minisymposium on Inverse Problems of Interest to DOD will be published. This Proceedings will be published as a special issue of the INVERSE PROBLEMS journal; the editors of the Proceedings will be Professor Joyce Mclaughlin and Professor David Colton.

Submitted by

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